Abstract

In this thesis, we have investigated and proposed a framework for multiresolution analysis and reconstruction, and multiscale edge detection using Radon space approach We have studied the problem of multiscale edge detection directly from projection data. It is shown that IRT (Inverse Radon Transform) of a smoothing function reconstructs a 2-D radial smoothing function This proof has been extended to show that IRT of set of 1-D wavelets is a 2-D radial wavelet The relationship between the gradient and zero crossing edge detection operator in image space and the corresponding operators in projection space has been derived This forms the basis for multiscale edge detection algorithms Further it is shown that IRT of wavelet coefficients obtained using 1-D spline wavelets does not give good edge results 1-D spline wavelets need to be weighted with $\cos\theta$ and $\sin\theta$, where θ is the projection angle, so that the 2-D wavelet coefficients reconstructed using CBP algorithm correspond to partial derivative images in image domain A truly gradient image can be formed with these partial derivative images which is used for edge detection.

Mutiscale edge detection algorithms based on above analysis are classified in to two classes First class of algorithms are based on gradient approach for detecting edges and the second class of algorithms are based on detection of zero crossings Different post processing techniques such as direct thresholding, tracking and Block Iterative Threshold Selection are proposed. Different edge detection algorithms based on these post processing techniques are presented under each class.

The efficacy of the proposed algorithms is shown for multiresolution reconstruction and multiscale edge detection using Radon space approach. The performance of these algorithms is studied for both original and noisy images The performance of a new Block Iterative Threshold Selection algorithm is found to be equally good as compared to the algorithm involving tracking as one of the post processing technique for edge detection It

was concluded that in general, edge information is captured well at 2nd scale in multiscale edge analysis and that higher order splines may be needed for higly noisy images